

# NASA TECH BRIEF

## *Lewis Research Center*



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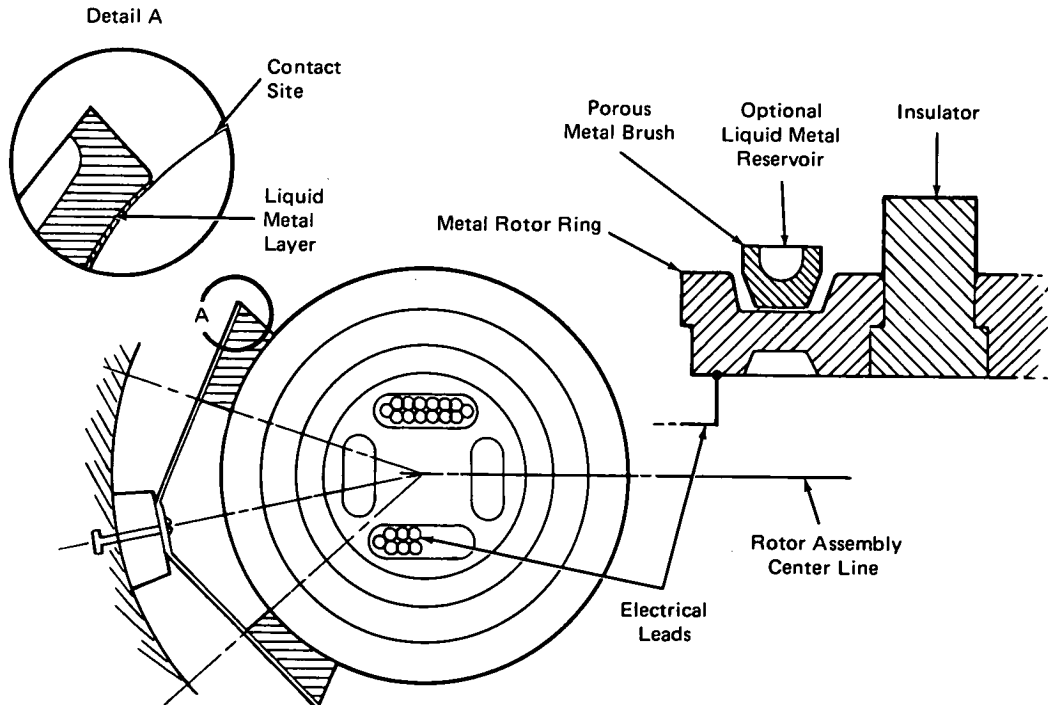
### Liquid Metal Porous Matrix Sliding Electrical Contact: A Concept

#### The problem:

Two types of slip rings are conventionally used to provide an electrical connection between the stationary and rotating parts of electrical machinery. One type uses a solid, electrically conductive brush and mechanical slip ring assembly to make the electrical contact between the rotating parts. The other type makes use of a liquid metal in the intervening space between the rotor and brush to provide the electrical path between

the two members. Both have operating limitations.

Solid mechanical slip rings are subject to wear, high friction forces, electrical noise, debris formation, tendency to vacuum weld when static, and difficulty in retaining surface coatings in extended use. Present liquid metal slip rings are subject to debris formation, difficulty in retaining the liquid metal in the desired location and shape, and exposure of a relatively large liquid metal surface area promoting vaporization and contamination.



Porous Metal Sliding Contact

(continued overleaf)

**The solution:**

This concept utilizes a porous metal or nonmetal matrix containing liquid metal in the porous structure and which confines the liquid metal to the contact area between rotor and brush by capillary forces.

**How it's done:**

The figure shows a conceptual assembly employing a porous metal brush filled with liquid gallium in contact with a solid metal rotor. The pore size and direction of the porous matrix grade and the brush-rotor separation are selected to provide for the proper direction of liquid metal flow into the contact space between rotor and brush under the influence of capillary forces. The edges of the brush at the contact site and the brush-rotor separation are designed to retain the liquid metal at the moving contact site only and reduce its exposure to the operating environment.

Alternate configurations and designs include the use of porous metal rotors with porous metal brushes, or porous metal rotors and solid metal brushes. The system may also be used to lubricate bearing systems.

**Notes:**

1. This application has advantages over conventional mechanical slip rings in reduced friction, reduced wear, reduced electrical resistance, and ease of fabrication due to fewer complex mechanical parts. Advantages over conventional liquid metal slip rings include reduced exposure of the liquid metal to contaminants, reduced debris accumulation, location and exposure of liquid metal surfaces only in the vicinity of the contact site, and more intimate contact of liquid metal with solid components.
2. No additional documentation is available. Specific questions, however, may be directed to:

Technology Utilization Officer  
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21000 Brookpark Road  
Cleveland, Ohio 44135  
Reference: B73-10164

**Patent status:**

NASA has decided not to apply for a patent.

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(LEW-11735)